

Ticosonde/NAME '04 Science Plan

Summary

The Ticosonde/NAME 2004 Experiment is a collaborative program of intensive (4 times daily) rawinsonde observations that will be carried out during the summer of 2004 at Juan Santamaria International Airport, Alajuela, Costa Rica. Participating institutions are the Instituto Meteorológico Nacional (IMN), the Universidad de Costa Rica (UCR), the Universidad Nacional (UNA), the Centro Nacional de Alta Tecnología (CENAT), and NASA-Ames Research Center.

A total of 340 rawinsonde ascents are planned, beginning June 16 and concluding by September 8, 2004. During the months of July and August, the soundings will be made with the Vaisala RS-90-AG radiosonde, the remainder with the Vaisala RS80-15G sonde. The Ticosonde/NAME rawinsonde observations will form part of the extended observational coverage for the North American Monsoon Experiment (NAME) in the summer of 2004.

With the majority of the soundings made with the higher sensitivity to water vapor and reduced temperature bias of the sensors in the RS90, the Ticosonde/NAME dataset will provide a unique high-frequency and high-accuracy database of wind, temperature and relative humidity observations. Of particular emphasis will be studies that will benefit research under the NASA Tropical Cloud Systems and Processes (TCSP) program which plans an aircraft campaign staged at Juan Santamaria Airport in July and August 2005.

Students from the meteorology and atmospheric chemistry programs at the two universities will take part in the radiosonde launch program as well as analyze the data collected as part of their academic programs and report their results to the TCSP Science Team prior to the TCSP field campaign.

The Ticosonde/NAME program has been made possible through support from the Earth Science Enterprise at NASA and the NOAA Office for Global Programs in the United States and, in Costa Rica, from the IMN, CENAT and the Comité Regional Recursos Hidráulica (CRRH).

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A. Science Goals

1. To improve our knowledge of the mean vertical structure and temporal variability of temperature, winds and humidity in the Costa Rican wet season through investigation of temporal variability on (a) interannual, (b) synoptic, and (c) diurnal timescales as well as (d) the pre- and post-convective evolution of the vertical structure.
2. To investigate the temporal variability of temperature and humidity of the tropical upper troposphere and lower stratosphere (UT/LS) over Costa Rica through studies of (a) temporal behavior of the tropopause height, temperature, winds and humidity and (b) gravity wave disturbances, forced both locally and remotely.
3. To compare the mean structure and variability between the mid-summer drought or “veranillo” in July and the peak of the wet season in September. This will also include studies of the changes during the pre- and post-veranillo periods.
4. To better understand the environmental conditions associated with the development of rain systems, particularly the extended systems known as *temporales*.
5. Comparison with historical data, particularly with respect to ENSO variations
6. To understand the structure and variability in the boundary layer, including (a) the vertical structure of the boundary layer and (b) diurnal variations of surface winds.

B. Programmatic goals

- To provide a preview of atmospheric conditions in the greater Costa Rican region for the NASA Tropical Cloud Systems and Processes airborne mission in summer 2005.
- To extend the observational network of the North American Monsoon Experiment in summer 2004.
- To assemble a team of students in atmospheric sciences who will launch radiosondes, analyze the data, and then, using the experience gained from the project, to be active participants in the TCSP mission in the summer of 2005.

C. Observational Approach

Under IMN's routine rawinsonde observational program at Juan Santamaria, there is a single sonde ascent per day at 12 UT (0600 local time). This will be increased to four times per day beginning June 16, 2004, continuing through the first week in September.

In order to take advantage of their increased sensitivity to humidity, particularly in the cold upper troposphere, the Vaisala RS90-AG radiosondes will be used in the period July 1 through August 31. The ascents in June and in September will be carried out with the RS80-15G sonde used in the routine IMN program.

The RS90 radiosondes will be flown with 350-g radiosonde balloons. This is in order to insure an average burst altitude above 20 mb.

NASA will supply 160 RS90-AG sondes and an additional 30 RS90s each will be supplied by the NOAA Office for Global Programs, CENAT and the Comité Regional de Recursos Hidrologicos (CRRH). In addition, 90 RS80-15G sondes will be provided by IMN.

D. Rawinsonde operations and data protocol

1. If an ascent is terminated in the first 1/2 hour after launch, a second ascent will be attempted subject to the discretion of the operator.
2. The DigiCORA EDT datastream will be captured to a PC on site for both archival and subsequent distribution.
3. The DigiCORA datastream will be configured to provide data at the highest data rate possible for the on-site PC. The maximum data rate is 1 report every 2 seconds.

E. Data distribution and processing

IMN will transmit the normal TEMP and PILOT messages generated by the DigiCORA. The additional time-based data in the EDT datastream will be archived and transmitted to NASA Ames and the other investigators in a timely manner. The latter data will serve as the basis for corrections of the relative humidity data by Larry Miloshevich at NCAR. The corrected data will then be stored in a web-accessible archive at NASA Ames.

F. Ancillary data

In addition to the EDT datastream data files, NASA-Ames will collect and archive the following ancillary data for use by the project:

1. Sounding data from MROC/78762 Juan Santamaria downloaded from U. of Wyoming (<http://weather.uwyo.edu/upperair/sounding.html>)
2. GOES-12 1/2 hourly IR and Visible imagery for Central America
3. AVN forecasts from GSFC Code 916
4. MROC surface data: (a) METARs (b) TAFs downloaded from NOAA ftp.

G. TCSP data analysis

Science questions 1 and 2 in Section A are of particular interest to the TCSP science community. Under the direction of the PIs, students from the University of Costa Rica and the National University will analyze the data and prepare their preliminary

results for presentation to Dr. Selkirk at the post-mission review in Fall 2004. These results will be reported to the TCSP science team at their initial meeting in early 2005.

H. Schedule of events

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| 10 June | Delivery of 250 RS90 sondes and balloons to IMN |
| 00 UT 16 June | Begin NAME rawinsonde observations (RS80-15G) |
| 21 – 25 June | Kick-off activities |
| 00 UT 1 July | Begin RS90 rawinsonde observations |
| 18 UT 31 August | Complete RS90 rawinsonde observations |
| Fall 2004 | Post-mission review |
| January 2005 | Presentation of results to TCSP science team |